

ABSTRACT

Raised structures comprising overlying silicon layers formed by controlled selective epitaxial growth, and methods for forming such raised-structure on a semiconductor substrate are provided. The structures are formed by selectively growing an initial epitaxial layer of monocrystalline silicon on the surface of a semiconductive substrate, and forming a thin film of insulative material over the epitaxial layer. A portion of the insulative layer is removed to expose the top surface of the epitaxial layer, with the insulative material remaining along the sidewalls as spacers to prevent lateral growth. A second epitaxial layer is selectively grown on the exposed surface of the initial epitaxially grown crystal layer, and a thin insulative film is deposited over the second epitaxial layer. Additional epitaxial layers are added as desired to provide a vertical structure of a desired height comprising multiple layers of single silicon crystals, each epitaxial layer have insulated sidewalls, with the uppermost epitaxial layer also with an insulated top surface. The resultant structure can function, for example, as a vertical gate of a DRAM cell, elevated source/drain structures, or other semiconductor device feature.